# MARINE ECOLOGY
## PROGRESS SERIES

**Volume 15 (1984)**

Editor
Otto Kinne

Biologische Anstalt Helgoland
Notkestraße 31, 2000 Hamburg 52
Federal Republic of Germany

IR
Inter-Research
1984

# Advisors

Advisors to 'Marine Ecology – Progress Series' are appointed for a four-year period. They are expected to:

- ○ critically evaluate the scientific merits of manuscripts submitted for publication
- ○ suggest topics and authors for reviews
- ○ select and present suitable high-quality manuscripts
- ○ draw attention to new facts, concepts and methods

In addition to the advisors listed below, about 300 referees cooperate anonymously.

## ENVIRONMENTAL FACTORS

**Alderdice, D., Dr.**
Pacific Biological Station, Nanaimo, B.C. V9R 5K6, Canada
Responses to environmental stress

**Dring, M. J., Dr.**
Botany Dept, The Queen's Univ. of Belfast, Belfast BT7 1NN, Northern Ireland
Physiological ecology of algae

**Gunkel, W., Dr.**
Biologische Anstalt Helgoland, D-2192 Helgoland, Federal Republic of Germany
Environmental effects on bacterial growth

**Haedrich, R. L., Prof.**
Memorial University of Newfoundland, St. John's, Nfld. A1B 3X9, Canada
Environmental effects on fishes

**Hedgpeth, J., Prof.**
5660 Montecito Avenue, Santa Rosa, Calif. 95404, USA
Temperature effects on marine organisms; interactions of organisms

**Jansson, B.-O., Prof.**
Askö Lab., Inst. of Mar. Ecol., Univ. of Stockholm, Box 6801, S-113 86 Stockholm, Sweden
Environmental effects on invertebrates

**Lawrence, J., Prof.**
Dept of Biology, Univ. of South Florida, Tampa, Fla 33620, USA
Physiological ecology of invertebrates

**MacLeod, R. A., Prof.**
Dept of Microbiology, MacDonald Campus of McGill Univ., MacDonald College, Que. H9X 1C0, Canada
Physiological ecology of microorganisms

**Meyers, S., Prof.**
Dept of Food Science, Louisiana State Univ., Baton Rouge, LA 70803, USA
Physiological ecology of microorganisms

**Morita, R. Y., Prof.**
Dept of Microbiology, Oregon State Univ., Corvallis, Oreg. 97331, USA
Environmental effects on microorganisms

**Newell, R. C., Prof.**
Institute for Marine Environmental Research, Prospect Place, The Hoe, Plymouth PL1 3DH, England
Environmental relations of intertidal animals

**Nultsch, W., Prof.**
Fachbereich Biologie der Philipps-Univ., Lahnberge, D-355 Marburg, Federal Republic of Germany
Light effects on plants; locomotion of microorganisms

**Rheinheimer, G., Prof.**
Institut für Meereskunde, Univ. Kiel, Düsternbrooker Weg 20, D-2300 Kiel, Federal Republic of Germany
Environmental effects on microorganisms

**Scheltema, R. S., Dr.**
Woods Hole Oceanographic Institution, Woods Hole, MA 02543, USA
Biogeography and evolution of benthic invertebrates

**Segal, E., Prof.**
Dept of Biology, California State Univ., Northridge, Calif. 91330, USA
Physiological ecology of invertebrates

**Sidell, B. D., Prof.**
Dept of Zoology, Univ. of Maine at Orono, Murray Hall, Orono, MA 04469, USA
Physiological ecology of fishes

**Southward, A. J., Dr.**
The Laboratory, Citadel Hill, Plymouth PL1 2PB, England
Environmental effects on invertebrates

**Vernberg, J., Prof.**
Belle W. Baruch Institute for Marine Biol. and Coastal Res., Univ. of South Carolina, Columbia, S. C. 29208, USA
Physiological ecology of invertebrates

**Winter, J. E., Dr.**
Instituto de Zoología, Univ. Austral de Chile, Casilla 567, Valdivia, Chile
Physiological ecology of invertebrates

**Woodhead, D. S., Dr.**
Ministry of Agriculture, Fisheries and Food, Fisheries Radiobiological Lab., Hamilton Dock, Lowestoft, Suffolk NR32 1DA, England
Effects of radioactivity

**ZoBell, C. E., Prof.**
Scripps Institution of Oceanography, San Diego, P.O.B. 1529, La Jolla, Calif. 92093, USA
Environmental effects on microorganisms

## PHYSIOLOGICAL MECHANISMS

**Battaglia, B., Prof.**
Istituto di Biologia Animale dell'Università, Via Loredan 10, I-35100 Padova, Italy
Population genetics; evolution

**Bayne, B. L., Dr.**
Institute for Marine Environmental Research, Prospect Place, The Hoe, Plymouth PL1 3DH, England
Comparative physiology

**Beardmore, J. A., Prof.**
Univ. College of Swansea, Dept of Genetics, Singleton Park, Swansea SA2 8PP, U.K.
Adaptation; selection

**Bonotto, S., Prof.**
Centre d' Etude de l'Energie Nucléaire, Lab du C.E.N./S.C.K., B-2400 Mol, Belgium
Cellular biology and sexuality

**Bulnheim, H.-P., Prof.**
Biologische Anstalt Helgoland, Palmaille 9 D-2000 Hamburg 50, Federal Republic o Germany
Metabolic performance of invertebrates; re productive biology and sexuality

**Costlow, J. D., Jr., Prof.**
Duke University Marine Laboratory, Piver Island, Beaufort, N.C. 28516, USA
Developmental physiology; endocrinology

**Enright, J. T., Prof.**
Scripps Institution of Oceanography, Sa Diego, P.O.B. 1529, La Jolla, Calif. 9209 USA
Biological rhythms

**Gerking, S. D., Prof.**
Dept of Zoology, Arizona State Univ.,Tempe Arizona 85281, USA
Fish physiology

**Holland, N. D., Dr.**
Scripps Institution of Oceanography, Sa Diego, P.O.B. 1529, La Jolla, Calif. 9209 USA
Comparative, cellular and developmenta physiology

**Humphrey, G. F., Dr.**
CSIRO Marine Biochemistry, Building A1 Sydney Univ., N.S.W. 2006, Australia
Photosynthesis; plankton biochemistry

**Levandowsky, M. Dr.**
Haskins Laboratories at Pace Univ., 41 Par Row, New York, N.Y. 10038, USA
Chemosensory mechanisms

**Naylor, E., Prof.**
School of Animal Biology, Univ. Coll. Nort Wales, Bangor, Gwynedd, LL57 2UW, U.K.
Behavioural physiology

**Russell, G., Dr.**
Dept of Botany, Univ. Liverpool, P.O.B. 14 Liverpool L69 3BX, England
Genetics of algae

**Siebers, D., Dr.**
Biologische Anstalt Helgoland, Palmaille 9 D-2000 Hamburg 50, Federal Republic o Germany
Comparative biochemistry and physiologic ecology of invertebrates

**Zhirmunsky, A. V., Prof.**
Institute of Marine Biology, Vladivosto 690022, USSR
Mechanisms of cellular resistance and co trol

## LTIVATION

**dach, J. E., Prof.**
t-West Resources Systems Institute, The t-West Center, 1777 East-West Road, Honolulu, Hawaii 96848, USA
eral aspects of cultivation; aquaculture

**o, M., Dr.**
tsche Gesellschaft für Technische Zumenarbeit mbH, Postfach 5180, D-6236 nborn 1, Federal Republic of Germany
aculture; food webs

**otto, S., Prof.**
tre d'Étude de l'Énergie Nucleaire, Lab. C.E.N./S.C.K., B-2400 Mol, Belgium
tivation of multicellular algae including aculture

**op, M. R., Dr.**
ttish Marine Biological Ass., Dunstaffnage Marine Res. Lab., P.O.B. 3, Oban, Argyll 34 4AD, Scotland
rition of algae

**ver, J. E., Prof.**
lege of Fisheries, Univ. of Washington, ttle, Wash. 98195, USA
rition of fishes in aquaculture

**rence, J., Prof.**
t of Biology, Univ. of South Florida, Tam- Fla 33620, USA
rition of invertebrates

**andowsky, M., Dr.**
kins Laboratories at Pace Univ., 41 Park , New York. N.Y. 10038, USA
rocosm cultures

**gne, F., Prof.**
v. de Paris VI, Inst. de Biologie Végétale, R 59, 7, Quai Saint-Bernard, F-75230 Paris Cedex 05, France
tivation of algae, excluding aquaculture

**ers, S. P., Prof.**
t of Food Science, Louisiana State Univ., on Rouge, LA 70803, USA
tivation of microorganisms and crustans; aquaculture

**enhöfer, G.-A., Prof.**
daway Institute of Oceanography, Univ. tem of Georgia, P.O.B. 13687, Savannah, rgia 31406, USA
tivation of zooplankton

**dian, T. J., Prof.**
ool of Biological Sciences, Madurai Kaaj Univ., Madurai 625 021, Tamilnadu, a
tivation of decapods and fishes; Bioenercs

**inheimer, G., Prof.**
itut für Meereskunde, Univ. Kiel, Dünbrooker Weg 20, D-2300 Kiel, Federal ublic of Germany
tivation of microorganisms

**enthal, H., Dr.**
ogische Anstalt Helgoland, Palmaille 9, 000 Hamburg 50, Federal Republic of many
tivation of and environmental effects on es

**ner, J. H., Dr.**
ter for Marine Biotechnology, Harbor nch Institution, RR 1, Box 196 A, Ft. Pierce Fla 33450, USA
ivation of aquatic plants

**lermann, C. J., Dr.**
Dept of Commerce, NOAA, National ine Fisheries Service, Northeast Fishs Center, Sandy Hook Lab., Highlands, 07732, USA
aculture; effects of diseases

**Ukeles, R., Dr.**
U.S. Dept of Commerce, NOAA, National Marine Fisheries Service, Northeast Fisheries Center, Milford Lab., 212 Rogers Ave, Milford, Conn. 06460, USA
Cultivation of unicellular algae

**Westernhagen, H. von, Dr.**
Biologische Anstalt Helgoland, Palmaille 9, D-2000 Hamburg 50, Federal Republic of Germany
Cultivation of crustaceans and fishes

**Winter, J. E., Dr.**
Instituto de Zoología, Univ. Austral de Chile, Casilla 567, Valdivia, Chile
Cultivation of invertebrates

**ZoBell, C. E., Prof.**
Scripps Institution of Oceanography, San Diego, P.O.B. 1529, La Jolla, Calif. 92093 USA
Cultivation of microorganisms

## DYNAMICS

**Anraku, M., Prof.**
Nansei Regional Fisheries Research Lab., 7782-9 Maruishi, Onocho, Saeki-gun, Hiroshima Prefecture, Japan
Planktology; primary and secondary production

**Arndt, E. A., Prof.**
Wilhelm-Pieck-Universität Rostock, Sektion Biologie, Freiligrathstr. 7/8, DDR-2500 Rostock, German Democratic Republic
Ecological dynamics of brackish waters

**Bak, R. P. M., Dr.**
Caribbean Marine Biological Institute, P.O. Box 2090, Willemstad, Curaçao, Netherlands Antilles
Coral-reef ecology

**Banse, K., Prof.**
Dept of Oceanography, Univ. Washington, Seattle, Wash. 98195, USA
Biological oceanography; plankton research

**Barnes, R. S. K., Dr.**
Dept of Zoology, Univ. Cambridge, Downing Street, Cambridge CB2 3EJ, England
Ecology of estuaries, lagoons and soft-sediment habitats

**Bianchi, A., Dr.**
Centre Nat. Rech. Scient. Ecologie et Biochimie Microbiennes du Milieu Marin, ER 223 3, Place Victor Hugo, F-13331 Marseille, France
Marine microbiology

**Birkeland, C., Prof.**
Univ. of Guam, Marine Laboratory, UOG Station, Mangilao, GUAM 96913
Coral-reef ecology

**Bonner, W. N., Mr.**
British Antarctic Survey, High Cross Madingley Rd, Cambridge CB3 OET, England
Polar ecology

**Bunt, J. S., Dr.**
Australian Institute of Marine Science, P M B No. 3, Townsville M.S.O., Q. 4810, Australia
Mangrove systems; reef studies

**Conover, R. J., Dr.**
Marine Ecology Laboratory, Bedford Institute of Oceanography, P.O.B. 1006, Dartmouth, N.S. B2Y 4A2, Canada
Plankton biology

**Cushing, D. H., Dr.**
Ministry of Agriculture, Fisheries and Food, Fisheries Laboratory, Lowestoft, Suffolk NR33 OHT, England
Productivity of the sea; fish-population dynamics

**Dethlefsen, V., Dr.**
Institut für Küsten- u. Binnenfischerei, Laboratorium Cuxhaven, Niedersachsenstr., D-219 Cuxhaven, Federal Republic of Germany
Diseases of fish populations

**Fenchel, T., Prof.**
Institute of Ecology and Genetics, Univ. of Aarhus, Ny Munkegade, Building 550, DK-8000 Aarhus C, Denmark
Population biology; microbial ecology

**Field, J. G., Prof.**
University of Cape Town, Zool. Dept, Rondebosch 7700, Republic of South Africa
Dynamics of nearshore ecosystems

**Fishelson, L., Prof.**
Dept of Zoology, Tel-Aviv Univ., Tel-Aviv, Israel
Population dynamics in shallow-water benthic communities; adaptation

**Gerlach, S. A., Prof.**
Institut für Meereskunde, Düsternbrooker Weg 20, D-2300 Kiel, Federal Republic of Germany
Benthos ecology

**Golikov, A. N., Dr.**
Zoological Institute, Academy of Sciences, Leningrad, V-164, USSR
Dynamics of biocoenoses

**Gray, J., Prof.**
Institutt for Marinbiologi og Limnologi, Postboks 1064, Oslo, Norway
Soft-sediment ecology

**Haedrich, R. L., Prof.**
Memorial University of Newfoundland, St. John's Nfld. A1B 3X9, Canada
Zoogeography

**Halver, J. E., Prof.**
College of Fisheries, Univ. of Washington, Seattle, Wash. 98195, USA
Fish nutrition

**Herman, L. M., Prof.**
Dept of Psychology, Univ. Hawaii at Manoa, 2430 Campus Road, Honolulu, Hawaii 96822, USA
Ecology and behavior of cetaceans

**Hessler, R. R., Dr.**
Scripps Institution of Oceanography, San Diego, P.O.B. 1529, La Jolla, Calif. 92093, USA
Deep-sea ecology

**Hoek, C. van den, Prof.**
Biol. Centrum der Rijksuniversiteit te Groningen, Afd. Plantensystematiek, Kerklaan 30, Haren (Gr.), The Netherlands
Phytogeography

**Holm-Hansen, O., Dr.**
Scripps Inst. of Oceanography, Univ. of Calif., La Jolla, Calif. 92093, USA
Polar ecology

**Jansson, B.-O., Prof.**
Askö Lab., Inst. Mar. Ecol., Univ. of Stockholm, Box 6801, S-113 86 Stockholm, Sweden
Modelling of ecosystems

**Kühlmann, D., Dr.**
Museum für Naturkunde der Humboldt-Univ., Invalidenstr. 43, DDR 104 Berlin, German Democratic Republic
Coral-reef ecology

**Lawrence, J., Prof.**
Dept of Biology, Univ. of South Florida, Tampa, Fla 33620, USA
Reproduction of invertebrates

**Levandowsky, M., Dr.**
Haskins Laboratories at Pace Univ., 41 Park Row, New York, N.Y. 10038, USA
Ecological modelling; phytoplankton ecology

**Levings, C., Dr.**
West Vancouver Laboratory, 4160 Marine Drive, West Vancouver, B.C. V7V 1N6 Canada
Estuarine ecology of macrobenthos and fish

**Lewis, J. B., Dr.**
McGill University, Redpath Museum, 859 Sherbrooke Street West, Montreal, PQ H3A 2K6 Canada
Coral-reef ecology

**Mauchline, J., Dr.**
Scottish Marine Biological Ass., Dunstaffnage Marine Res. Lab., P.O.B. 3, Oban PA34 4AD, Argyll, Scotland
Deep-sea ecology

**Nixon, Scott W., Prof.**
Univ. Rhode Island, Graduate School of Oceanogr., Narragansett Bay Campus, Kingston, R.I. 02881, USA
Coastal ecology; nutrient dynamics; wetlands

**Paffenhöfer, G.-A., Prof.**
Skidaway Institute of Oceanography, Univ. System of Georgia, P.O.B. 13687, Savannah, Georgia 31406, USA
Plankton ecology

**Parsons, T. R., Prof.**
Dept of Oceanography, Univ. of British Columbia, 6270 University Boulevard, Vancouver, B.C. V6T 1W5, Canada
Biological oceanography

**Pearse, J. S., Prof.**
Center for Coastal Marine Studies, Univ. of California, Santa Cruz, Calif. 95064, USA
Kelp forest ecology; Reproductive ecology

**Pérès, J. M., Prof.**
Station Marine d'Endoume et Centre d'Oceanographie, Rue de la Batterie-des-Lions, Marseille (7e), France
Organismic zonations and assemblages

**Pichon, M., Dr.**
James Cook Univ. North Queensland, Q. 4811, Australia
Coral-reef ecology

**Platt, T., Dr.**
Marine Ecology Laboratory, Bedford Institute of Oceanography, P.O.B. 1006, Dartmouth, N.S. B2Y 4A2, Canada
Phytoplankton ecology

**Rao, T. S. S., Dr.**
National Institute of Oceanography, Biol. Div., Dona Paula – 403 004, Goa, India
Biological oceanography

**Robertson, R., Dr.**
The Academy of Natural Sciences, 19th & The Parkway, Philadelphia, PA 19103, USA
Mollusc ecology

**Scarlato, O., Prof.**
Zoological Institute, Academy of Sciences, Leningrad, V-164, USSR
Dynamics of biocoenoses

**Scheltema, R. S., Dr.**
Woods Hole Oceanographic Institution, Woods Hole, MA 02543, USA
Reproduction of benthic invertebrates

**Skjoldal, H. R., Dr.**
Institute of Marine Research, Postboks 1870, N-5011 Bergen-Nordnes, Norway
Food webs and trophic interactions

**Southward, A. J., Dr.**
The Laboratory, Cital Hill, Plymouth PL1 2PB, England
Rocky-coast ecosystems

**Tenore, K. R., Prof.**
Skidaway Institute of Oceanography, Univ. Systems of Georgia, P.O.B. 13687, Savannah, Georgia 31406, USA
Benthic ecology and bioenergetics

**Thayer, G. W., Dr.**
Ecosystem Structure Branch, Southeast Fisheries Center, Beaufort, N. C. 28516-9722, USA
Wetlands ecology, incl. submerged seagrasses and emergent marshes

**Vinogradov, M. E., Prof.**
P. P. Shirshov Institute of Oceanology, Academy of Sciences of USSR, 1, Letnaya (Ljublino), Mocow 109387, USSR
Oceanic plankton ecosystems

**Wangersky, P. J., Prof.**
Dept of Oceanography, Dalhousie Univ., Halifax, N.S., B3H 4J1, Canada
Organic matter in sea water; theoretical population dynamics

**Warwick, R. M., Dr.**
Institute for Marine Environmental Research, Prospect Place, The Hoe, Plymouth PL1 3DH, England
Structure and functioning of benthic communities; meiofaunal ecology

**Zijlstra, J. J., Dr.**
Nederlands Instituut voor Onderzoek der Zee, Postbox 59, Den Burg – Texel, The Netherlands
Food webs; population dynamics

## OCEAN MANAGEMENT

**Alderdice, D., Dr.**
Pacific Biological Station, Nanaimo, B.C. V9R 5KR, Canada
Organismic responses to pollution

**Bardach, J. E., Prof.**
East-West Resources Systems Institute, The East-West Center, 1777 East-West Road, Honolulu, Hawaii 96848, USA
Management of tropical marine environments; fisheries

**Barnes, R. S. K., Dr.**
Dept of Zoology, Univ. Cambridge, Downing Street, Cambridge CB2 3EJ, England
Management of coastline habitats

**Battaglia, B., Prof.**
Istituto di Biologia Animale dell'Università, Via Loredan 10, I-35100 Padova, Italy
Genetic effects of pollutants

**Bayne, B. L., Dr.**
Institute for Marine Environmental Research, 67/69 Citadel Road, Plymouth PL1 3DH, England
Stress and pollution

**Beardmore, J. A., Prof.**
Univ. College of Swansea, Dept of Genetics, Singleton Park, Swansea SA2 8PP, U.K.
Genetic effects of pollution

**Bernhard, M., Dr.**
ENEA, P.O.B. 316, I-19100 La Spezia, Italy
Radioactive and conventional pollution

**Bryan, G. W., Dr.**
Marine Biological Ass. of the U.K., The Laboratory, Citadel Hill, Plymouth PL1 2PB, England
Heavy metal pollution

**Eisler, R., Dr.**
U.S. Dept of the Interior, Fish and Wildlife Service, Office of Biol. Services, Washington D.C., 20240, USA
Toxicology and pollution

**Ernst, W., Dr.**
Institut für Meeresforschung, Am Handelshafen 12, D-2850 Bremerhaven-1, Federal Republic of Germany
Pollution due to organic chemicals

**Gray, J., Prof.**
Institutt for Marinbiologi og Limnologi, Postboks 1064, Oslo, Norway
Pollution effects on benthos animals

**Gulland, J. A., Dr.**
Food and Agriculture Organization of the United Nations, Via delle Terme di Caracalla, I-00100 Rome, Italy
Management of fishery resources

**Gunkel, W., Dr.**
Biologische Anstalt Helgoland, D-2192 Helgoland, Federal Republic of Germany
Oil degradation; oil pollution

**Lasker, R., Dr.**
US Dept of Commerce, NOAA, Southwest Fisheries Center, P.O.B. 271, La Jolla, Calif. 92038, USA
Fishery biology; fishery resources

**Mauchline, J., Dr.**
Scottish Marine Biological Ass., Dunstaffnage Marine Res. Lab., P.O.B. 3, Oban PA34 4AD, Argyll, Scotland
Radioactive pollution

**Mironov, O. G., Dr.**
Inst. of Biology of South Seas, Academy of Sciences Uk.SSR, 2, Nahimov St., Sevastopol, USSR
Pollution due to oil and oil dispersants

**Norris, K. S., Prof.**
Environmental Field Program, University of California, Santa Cruz, Calif. 95064, USA
Marine mammal behavior and protection

**Riley, J. P., Prof.**
Dept of Oceanography, Univ. of Liverpool, Liverpool L69 3BX, England
Marine pollution chemistry

**Russell, G., Dr.**
Dept of Botany, Univ. Liverpool, P.O.B. 147, Liverpool L69 3BX, England
Pollution effects on algal communities

**Sherman, K., Dr.**
US Dept of Commerce, NOAA, Northeast Fisheries Center, South Ferry Rd, Narragansett, R.I. 02882, USA
Fisheries ecology; fishery resources

**Ukeles, R., Dr.**
U.S. Dept of Commerce, NOAA, National Marine Fisheries Service, Northeast Fisheries Center, Milford Laboratory, 212 Rogers Ave, Milford, Conn. 06460, USA
Pollution effects on algae

**Ursin, E., Dr.**
The Danish Institute for Fishery and Marine Research, Charlottenlund Slot, DK-2920 Charlottenlund, Denmark
Ecosystem organization; species interactions of importance to fisheries

**Zijlstra, J. J., Dr.**
Nederlands Instituut voor Onderzoek der Zee, Postbox 59, Den Burg – Texel, The Netherlands
Management of wadden-sea areas

# MARINE ECOLOGY – PROGRESS SERIES

**HISTORY:** 'Marine Ecology – Progress Series' (MEPS) was established in response to requests from numerous marine ecologists from all over the world. The series is based on 'Marine Ecology' – the first comprehensive, integrated treatise on life in oceans and coastal waters – conceived, organized and edited by Professor Otto Kinne and published by John Wiley & Sons.

**AIM:** 'Marine Ecology – Progress Series' serves as world-wide forum for all aspects of marine ecology, fundamental and applied. The journal covers microbiology, botany, zoology, ecosystem research, biological oceanography, fisheries, aquaculture, pollution, environmental protection, diseases, conservation and resource management.
Ecological research has become of paramount importance for man's future. The information presented here should, therefore, encourage critical application of ecological knowledge for the benefit of mankind and, in fact, of life on earth. 'Marine Ecology – Progress Series' strives for

- ◯ complete coverage of the field of marine ecology
- ◯ the highest possible quality of papers
- ◯ quick publication
- ◯ a high technical standard of presentation.

Editor and publisher attempt to achieve these goals in close cooperation with advisors, referees, contributors and readers. Criticism and advice are cordially invited (please address to the editor).

**SCOPE:** 'Marine Ecology – Progress Series' is international and interdisciplinary. Presenting research papers, reviews and notes, it has been created for prompt publication of contributions concerned with:

**Environmental Factors:** Tolerances and responses of marine organisms (microorganisms, autotrophic plants, and animals) to variations in abiotic and biotic components of their environment; radioecology.

**Physiological Mechanisms:** Synthesis and transversion of organic material (mechanisms of auto- and heterotrophy); thermo-, ion-, osmo- and volume regulation; stress resistance; non-genetic and genetic adaptation; population genetics; orientation in space and time; migrations; behaviour.

**Cultivation:** Maintenance and rearing of, as well as experimentation with, marine organisms under environmental and nutritional conditions which are, to a considerable degree, controlled; analysis of the physiological and ecological potential of individuals, populations and species; determination of nutritional requirements; ecological aspects of aquaculture; waterquality management; culture technology.

**Dynamics:** Production, transformation, and decomposition of organic matter in marine ecosystems; food webs; trophic interrelations; population dynamics; plankton ecology; benthos ecology; estuarine and coastal ecology; wadden-sea ecology; coral-reef ecology; deep-sea ecology; open-ocean ecology; polar ecology; theoretical ecology; ecological modelling; evolution; diseases of marine organisms.

**Ocean Management:** Applied marine field ecology; inventory, protection and management of living resources in coastal areas, estuaries and open oceans; ecological aspects of fisheries; pollution of marine areas and organisms; protection of life in the seas; management of populations, species and ecosystems; management of coastal zones and sea areas.

## Subscription

**1983: 4 volumes (10–13)**
North America: US $ 147.00 per volume.
Annual rate for 4 volumes: US $ 588.00 including postage, handling and insurance.

All other countries DM 256,00 per volume.
Annual rate for 4 volumes: DM 1024,00 plus postage, handling and insurance.

**1984: 6 volumes (14–19)**
North America: US $ 147.00 per volume.
Annual rate for 6 volumes: US $ 882.00 including postage, handling and insurance.

All other countries DM 266,00 per volume.
Annual rate for 6 volumes: DM 1596,00 plus postage, handling and insurance.

Special Conditions (for personal use of individual scientists only)
(1) Advisors: free copies.
(2) Staff referees: DM 48,00 per volume, providing their institutional library subscribes to the journal.
(3) All other scientists: DM 85,00 per volume, providing their institutional library subscribes to the journal.
(4) Students: DM 75,00 per volume, providing their university library subscribes to the journal.

Subscriptions are entered with prepayment only.

Missing issues must be claimed within 4 months after publication.

**Publisher:** Inter-Research, P.O.B. 1121, D-2083 Halstenbek, Federal Republic of Germany.

**Advertisements**

| | | | | | |
|---|---|---|---|---|---|
| 1/1 page | ready-to-print film | = US $ 70 | 1/2 page | ready-to-print film | = US $ 38 |
| | proof-requiring text | = US $ 100 | | proof-requiring text | = US $ 60 |

Copyright © Inter-Research, Halstenbek, 1984. All rights reserved. Mar. Ecol. Prog. Ser. 1984. Printed by Westholsteinische Verlagsdruckerei Boyens & Co., D-2240 Heide.

# Manuscript Preparation, Mailing and Processing

**Preparation**

Research papers (in general not exceeding 10 printed pages), reviews (up to 30 printed pages) and notes (1–3 printed pages) must be typewritten with double spacing. 'Marine Ecology – Progress Series' invites interpretative rather than descriptive contributions. Reviews should be critical, instructive evaluations of the state-of-the-art – not mere compilations of information.

Abstracts. All contributions must be preceded by a brief, concise abstract. In the shortest possible way, the abstract should outline the scope of the paper and highlight its main results and conclusions.

Figures must be very carefully prepared, numbered and accompanied by brief, precise legends. For examples consult recent issues. Mark desired position of figures in the manuscript margin.

Tables should not be excessive in size. They must be numbered and be headed by brief, compendious legends. Mark desired position of tables in the manuscript margin. Unusual symbols used must be explained.

Genus and species names: underline for *italics.* Genus names should appear in full the first time mentioned in a given paragraph.

Citation of literature. All literature quoted in the text must be listed, in alphabetical order of author names, at the end of the manuscript. Please abbreviate publications according to 'World List of Scientific Periodicals', latest edition, London. For examples o literature citation see below.

**Mailing**

Address manuscripts (original plus 2 copies) to ar advisor or to the editor. For safety use registered mail

**Processing**

Manuscripts are critically evaluated by at least reviewers. The editor then decides on acceptance o rejection. Acceptable manuscripts are usually returned to the author requesting consideration of comments and criticism. Present rejection rates range from 35 to 50 % for manuscripts from different parts of the world.

When an accepted manuscript is ready for publication the author will be notified and the date of manuscrip acceptance fixed. This date appears at the end of each printed contribution. Average time between accept ance and publication is 4 mo.

The author receives 2 sets of proofs directly from the printer. Printing errors must be carefully corrected. A this stage, stylistic changes are not acceptable withou compensatory payment. Please return 1 set of proofs by air mail.

Offprints: Sixty offprints (reprints) of each con tribution will be made available free of charge. Addi tional offprints can be purchased. For offprint prices consult the form accompanying the proofs. Orders fo additional offprints must be made when returning the proof (use the form provided).

---

'Marine Ecology – Progress Series' levies no page charge.
The last issue of each set of 10 volumes features a combined author/title index.

---

**Examples of Literature Citation**

**Periodicals**

Gray, J. S., Pearson, T. H. (1982). Objective selection of sensitive species indicative of pollution-induced change in benthic communities. I. Comparative methodology. Mar. Ecol. Prog. Ser. 9: 111-119

**Papers from serials/books**

Margalef, R. (1978). General concepts of population dynamics and food links. In: Kinne, O. (ed.) Marine ecology, Vol. IV, Dynamics. Wiley, Chichester, p. 617-704

**Books**

Steele, J. H. (1974). The structure of marine ecosystems. Blackwell, Oxford

---

**Copyright**

With the acceptance of a manuscript, the copyright is transferred to the publishers. Reproduction of any part of this publication by any means, as well as translation, requires their written permission. Trade marks or names appearing in this series may be subject to protective regulations or laws. The Article Fee Code (at the bottom of the first page of each paper) indicates the copyright holder's consent that, in the USA, copies of the paper may be made for personal or internal use. This consent is granted on condition that the copier pay the stated fee through the Copyright Clearance Center, Inc. P.O.Box 8891, Boston, Mass. 02114 for copying beyond that permitted by Section 107 or 108 of the US Copyright Law.

# CONTENTS

## Volume 15 · Numbers 1 and 2 · 1984

### RESEARCH PAPERS


**Hughes, R. G.**
A model of the structure and dynamics of benthic marine invertebrate communities 1–11

**López-Jamar, E., Iglesias, J., Otero, J. J.**
Contribution of infauna and mussel-raft epifauna to demersal fish diets 13–18

**Geesey, G. G., Alexander, G. V., Bray, R. N., Miller, A. C.**
Fish fecal pellets are a source of minerals for inshore reef communities 19–25

**Turner, J. T.**
Zooplankton feeding ecology: contents of fecal pellets of the copepods *Eucalanus pileatus* and *Paracalanus quasimodo* from continental shelf waters of the Gulf of Mexico 27–46

**Marcus, N. H.**
Recruitment of copepod nauplii into the plankton: importance of diapause eggs and benthic processes 47–54

**Kimmerer, W. J.**
Selective predation and its impact on prey of *Sagitta enflata* (Chaetognatha) 55–62

**Summerson, H. C., Peterson, C. H.**
Role of predation in organizing benthic communities of a temperate-zone seagrass bed 63–77

**Townsend, D. W.**
Comparison of inshore zooplankton and ichthyoplankton populations of the Gulf of Maine 79–90

**Buckley, L. J., Turner, S. I., Halavik, T. A., Smigielski, A. S., Drew, S. M., Laurence, G. C.**
Effects of temperature and food availability on growth, survival, and RNA-DNA ratio of larval sand lance *(Ammodytes americanus)* 91–97

**Moreno, C. A., Jara, H. F.**
Ecological studies on fish fauna associated with *Macrocystis pyrifera* belts in the south of Fueguian Islands, Chile 99–107

**Seiderer, L. J., Davis, C. L., Robb, F. T., Newell, R. C.**
Utilisation of bacteria as nitrogen resource by kelp-bed mussel *Choromytilus meridionalis* 109–116

**Kirchman, D. L., Mazzella, L., Alberte, R. S., Mitchell, R.**
Epiphytic bacterial production on *Zostera marina* 117–123

**Keser, M., Larson, B. R.**
Colonization and growth dynamics of three species of *Fucus* 125–134

**Crossland, C. J.**
Seasonal variations in the rates of calcification and productivity in the coral *Acropora formosa* on a high-latitude reef 135–140

**Lewis, M. R., Cullen, J. J., Platt, T.**
Relationships between vertical mixing and photoadaptation of phytoplankton: similarity criteria 141–149

**Zieman, J. C., Iverson, R. L., Ogden, J. C.**
Herbivory effects on *Thalassia testudinum* leaf growth and nitrogen content 151–158

**Pihl, L., Rosenberg, R.**
Food selection and consumption of the shrimp *Crangon crangon* in some shallow marine areas in western Sweden 159–168

**Goldman, J. C., Dennett, M. R.**
Effect of photoinhibition during bottle incubations on the measurement of seasonal primary production in a shallow coastal water 169–180


### REVIEW


**Sulkin, S. D.**
Behavioral basis of depth regulation in the larvae of brachyuran crabs 181–205


### NOTE


**Lewis, J. B., Storey, G. S.**
Differences in morphology and life history traits of the echinoid *Echinometra lucunter* from different habitats 207–211

Volume 15 · Number 3 · 1984

## RESEARCH PAPERS

**Abou Debs, C.**
Carbon and nitrogen budget of the calanoid copepod *Temora stylifera:* effect of concentration and composition of food 213–223

**Harding, L. W., Jr., Heinbokel, J. F.**
Periodicities of photosynthesis and cell division: behavior of phase-lagged replicate cultures of *Ditylum brightwellii* in a diurnally varying photic regime 225–232

**Astheimer, H., Haardt, H.**
Small-scale patchiness of the chlorophyll-fluorescence in the sea: aspects of instrumentation, data processing, and interpretation 233–245

**Ellery, W. N., Schleyer, M. H.**
Comparison of homogenization and ultrasonication as techniques in extracting attached sedimentary bacteria 247–250

**Schmidt, G. H., Warner, G. F.**
Effects of caging on the development of a sessile epifaunal community 251–263

**Bell, J. D., Galzin, R.**
Influence of live coral cover on coral-reef fish communities 265–274

**Bisol, P. M., Costa, R., Sibuet, M.**
Ecological and genetical survey on two deep-sea holothurians: *Benthogone rosea* and *Benthodytes typica* 275–28

**Jørgensen, C. B., Kiørboe, T., Møhlenberg, F., Riisgård, H. U.**
Ciliary and mucus-net filter feeding, with special reference to fluid mechanical characteristics 283–29

**Kunisch, M., Anger, K.**
Variation in development and growth rates of larval and juvenile spider crabs *Hyas araneus* reared in the laboratory 293–30

## NOTES

**Admiraal, W., Laane, R. W. P. M., Peletier, H.**
Participation of diatoms in the amino acid cycle of coastal waters; uptake and excretion in cultures 303–306

**Léger, P., Sorgeloos, P.**
International study on *Artemia.* XXIX. Nutritional evaluation of *Artemia* nauplii from different geographical origin for the marine crustacean *Mysidopsis bahia* 307–309